

## Experience and Results of the 1991 MTLRS#1 USSR Campaign

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**Abstract.** In the fall 1991 the Modular, Transportable Laser Ranging System MTLRS#1 was operating in the USSR for collocation of the SLR systems in Riga, Simeiz and Kazivelli. In this paper we will summarize the results of the collocation experiments and we will show our (positive and negative) experiences, we got during this campaign in the USSR).

### 1. Introduction

The year 1991 was a special year for the mobile laser ranging systems. Due to the scheduled upgrades of the Modular Transportable Laser Ranging Systems MTLRS#1 (operated by the IfAG, Germany) and MTLRS#2 (operated by the OSG Kootwijk, Netherlands) neither a WEGENER-MEDLAS nor a Crustal Dynamics Project campaign was carried out in 1991.

After the successful upgrade of MTLRS#1 in the first half of 1991 (P. Sperber et al.) the system departed from Wettzell in August to make measurements at two sites in the USSR.

In Riga/Latvia we operated close to the fixed SLR system, in Simeiz/Ukraine the place for MTLRS#1 pad was chosen to collocate the two fixed SLR station in Simeiz (300 m distance to MTLRS#1) and Kazivelli (about 3 km distance).

### 2. Results

An overview about the number and quality of the MTLRS#1 passes is shown in Fig. 1 and Fig. 2.

The system arrived in Riga during week 32. Because the crew was not yet familiar with some new parts of the system, which were installed during the upgrade, it took some days, before the first data were collected successfully.

In week 34 we were faced with a problem, we never had before: In Moscow parts of the Soviet army putched against Gorbachev. Due to the unclear and dangerous political and military situation we had to stop our observations again for nearly one week.

During the rest of measurements in Riga we were faced with extremely bad weather conditions. All these problems are showing in an unusual poor performance of MTLRS#1 in Riga. Neither the quantity (number of passes per week) nor the quality (number of normal points per pass) was completely satisfying.

After 43 Lageos passes we stopped the observations in Riga on October 3rd and moved the system to Simeiz.

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Here the system was able to show its habitual performance. After 53 Lageos passes with more than eleven normalpoints per pass in average the campaign was finished on November 23 rd.

The computation of the collocation was performed by the computing center of the IfAG in Frankfurt/Main. The results are summarized in Fig. 3 - Fig. 5.

Fig. 3 shows the results of the Riga collocation. We got 16 simultaneous Lageos passes with a R.M.S. of 20 cm at the Riga system and 1 cm or 2 cm at MTLRS#1 depending whether a PMT or a single photon avalanche diode (I. Prochazka et al., P. Sperber et al.) was used as receiver.

Out of this 16 passes six passes with good residual overlap (for example: Fig. 4) were selected to calculate the range and epoch bias of the Riga SLR system. There is a small negative tendency in both biases, but compared to the error values and the R.M.S. of the Riga system we can't find a significant bias.

Fig. 5 summarizes the results of the collocation in Simeiz. Because of problems, the fixed stations only were able to observe few passes during the collocation, but all of the passes were simultaneous with MTLRS#1.

The data of the fixed stations are not yet delivered to the network, so until now a computation was not possible.

### 3. Experience

In this chapter we will summarize our experience during the on-site operation and the transport of a dedicated geodetic system in the USSR.

#### 2.2. Operation on stations

From the operational point of view there were no problems as long as the system was working near stations. All our requirements concerning electrical power, safety, infrastructure, etc. were fulfilled. In Riga also the supply of fuel and the hotel accomodation were satisfying.

On all stations an independent communication facility like Inmarsat is necessary. The only local data channel is a very unreliable telex line.

In Simeiz, the hotel, food and fuelsituation is very inconvenient:

- A hotel near the station is far under western standard, an acceptable one is more than 40 km away.
- For fuel a big spare tank is necessary, because fuel is not always available.
- As there are no restaurants near the station, facilities are needed to prepare own food

Additionally most of the people only speak russian language.

In spite of this problems, the operation of a slr system near fixed stations is always possible, if some preparations are made to facilitate the life of the crew members.

#### 2.2. Transport between stations

During the transport of a system from one station to the other the situation becomes very bad compared to the operation on stations.

- Communication channels to foreign countries are not available in short time
- Hotels only exist in big cities. Sleeping facilities for all persons in cars (caravans) are strongly recommended because most of the hotels are full without reservation four weeks in advance.

- Food is only available in hotels, so there are facilities necessary to cook in the cars.
- Security is a big problem, day and night guards are absolutely necessary.
- Fuel is not always available, therefore big fuel tanks are needed in the cars.
- Car repair is possible, but takes a lot of time and you should have all spare parts with you.

The people only speak Russian (or sometimes German), but are very friendly and will always try to help if there are problems.

### 3. Summary

In the second half of 1991 the MTLRS#1 was operating successfully in Riga and Simeiz to collocate the fixed laser ranging stations on these places.

The results of the collocation show no significant problem at the Riga fixed SLR station. The collocation in Simeiz is not yet computed.

To operate and transport a dedicated geodetic system like MTLRS#1 in the underdeveloped regions of the USSR big efforts and preparations are necessary to become as independent as possible from the local infrastructure.

## REFERENCES

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- P. Sperber, U. Hessels, R. Motz in this Proceedings, *The new MTLRS#1 Receiver Package 1992.*

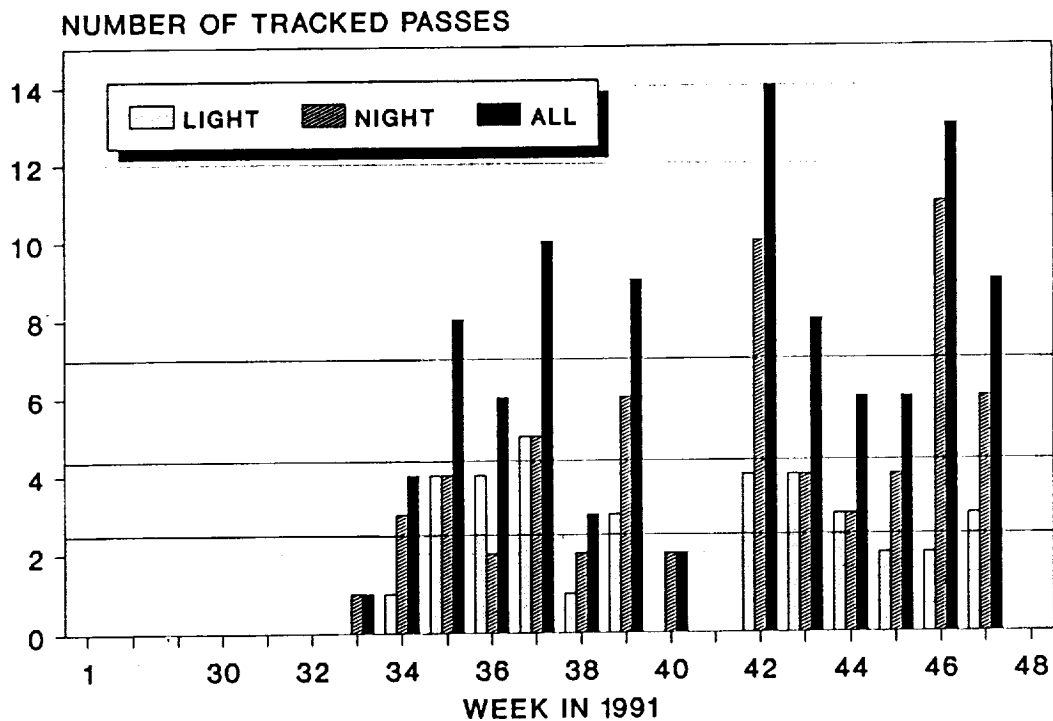


Fig. 1 Number of Lageos Passes in Riga and Simeiz

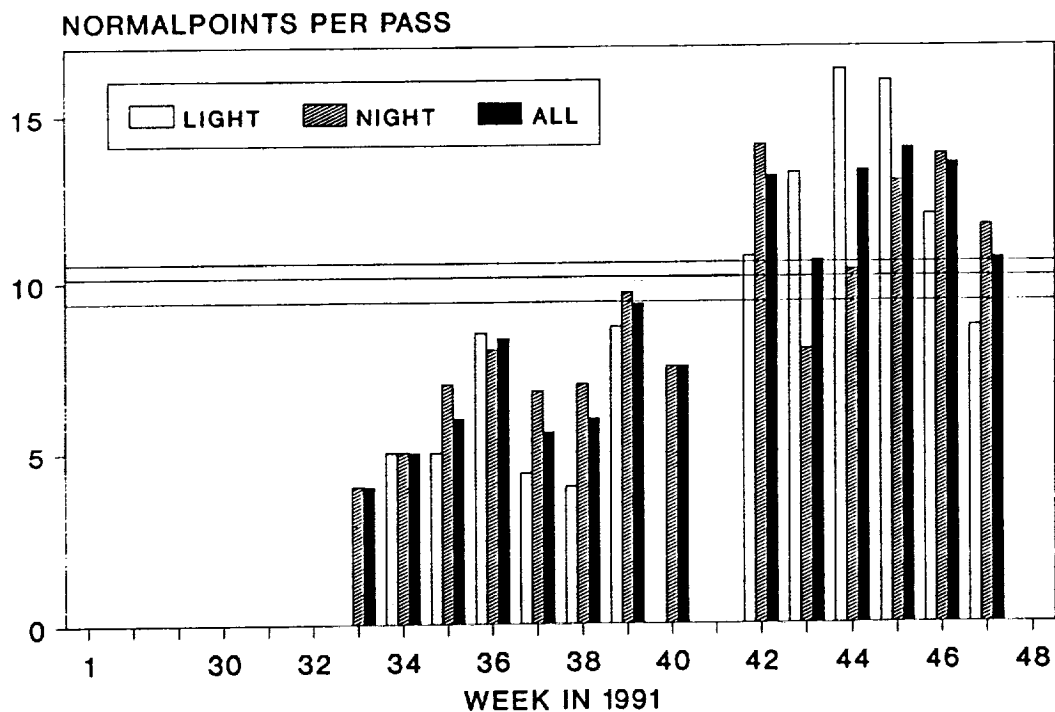


Fig. 2 Number of Normalpoints per Lageos pass in Riga and Simeiz

# Results

Riga (1884)	MTLRS#1 (7560)
15868 Returns	27166 Returns (43 Passes)
R.M.S. 20 cm	1 cm (SPAD) - 2 cm (PMT)

Aug. 15 - Oct. 10  
16 Simultaneous Passes

Range Bias 7560-1884 in cm	Epoch Bias 7560-1884 in microsec
-6.1	-24
-2.5	-30
-5.1	-58
-16.3	-23
-0.4	-4
-8.4	+66
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<i>-6.5 cm +- 5 cm</i>	<i>-12 microsec +- 30</i>

Fig. 3 Results of the collocation in Riga

## RANGE RESIDUALS

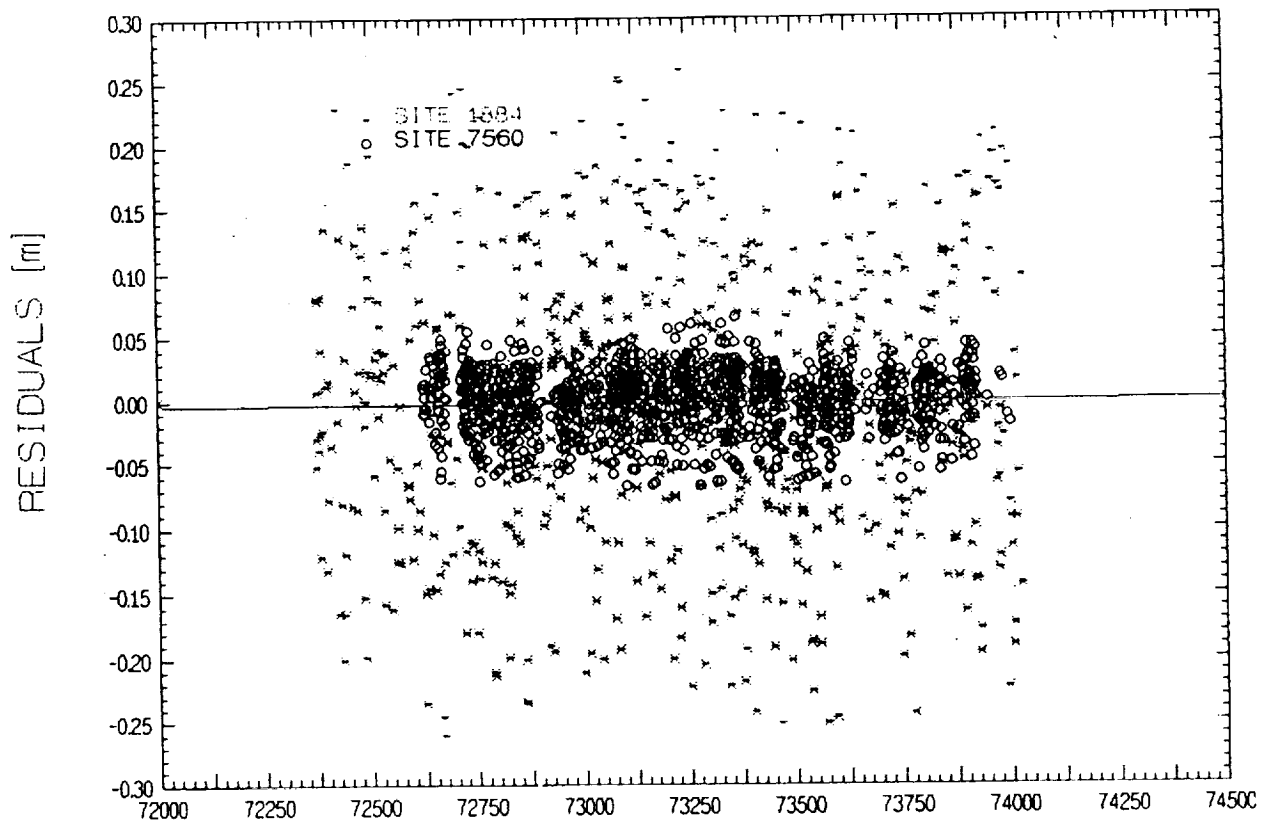


Fig. 4 Example of a Residual plot of a collocation pass between MTLRS-1 and the Riga fixed SLR station

# Results

Simeiz (1873)	Kazivelli (1893)	MTLRS#1 (7561)
R.M.S. 10 cm	10 cm	1 cm - 2 cm
10 Passes	20 Passes	53 Passes

Oct. 14 - Nov. 23

Data not yet processed

Fig. 5 Results of the collocation in Simeiz